PUMP-ACTION FIREARM

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Abstract

Provided is a pump-action firearm having a frame. A barrel having a chamber is supported on the frame. A rotating ammunition clip has a plurality of circumferentially spaced cartridge sockets and is removably supported by the frame. A bolt is manually slidably cycled between in-battery and retracted positions. The bolt is moveable into a socket to push a cartridge out of the socket and into the chamber to the in-battery position and retractable to extract the cartridge from the chamber and back into the socket.

Background/Summary

RELATED APPLICATIONS [0001] This application claims priority to U.S. Provisional Patent Application No. 63/131,501, filed Dec. 29, 2020, and incorporates the same herein by reference.

TECHNICAL FIELD

[0002] This invention relates to a pump-action firearm. More particularly, it relates to such a firearm

that uses a removable, rotating ammunition feeding clip which retains, rather than ejects, spent cartridge casings.

BACKGROUND

[0003] Various designs for a carbine rifle in a pistol caliber have been made with the intention of making a firearm that is both exceptionally reliable and low cost to manufacture. For various reasons, it may also be desirable to have a firearm that does not eject empty cartridge casings, but that has a higher ammunition capacity and is easier to reload than a traditional revolver. Traditional semi-automatic or pump-action rifles or shotguns that use a detachable magazine eject spent cartridge casings when the action is cycled.

SUMMARY OF THE INVENTION

[0004] Provided is a pump-action firearm having a frame. A barrel having a chamber is supported on the frame. A rotating ammunition clip has a plurality of circumferentially spaced cartridge sockets and is removably supported by the frame. A bolt is manually slidably cycled between in-battery and retracted positions. The bolt is moveable into a socket to push a cartridge out of the socket and into the chamber to the in-battery position and retractable to extract the cartridge from the chamber and back into the socket.

[0005] The firearm may be a carbine rifle, pistol caliber rifle, or a shotgun in a bullpup configuration. The pump-action cycling uses a removable and replaceable en bloc rotary ammunition clip (technically, not a magazine) that retains spent cartridge casings. The design is built on a simple frame that may be covered with removable side slab panels made from a lightweight plastic material. A spent cartridge is extracted, the hammer re-cocked, and a new cartridge fed into the chamber by a sliding bolt mechanism that is locked into place by vertical movement of one or more lock members, similar in some ways to that of a falling-block action.

[0006] A rotating en bloc clip is used as an ammunition feeding mechanism. This rotating cylinder clip (or “drum lette”) is not a true “magazine,” because it does not include a spring to self-advance a next round of ammunition and it retains empty cartridge casings after being fired. The rotating clip houses a series of circumferentially positioned cartridges in individual sockets. Radially arranged ratchet teeth on a rear face of the clip body are used to rotate it each time the action is manually cycled. There is no winding required, as is the case in a drum magazine, because it is not internally spring-driven.

[0007] The action moves linearly, as does each cartridge as it is chambered and extracted. This allows the use of any bullet shape in the cartridge, including full wadcutters (cylindrical projectile) to maximize bullet weight in subsonic loadings. The cartridge is fully and symmetrically supported in the chamber, as there is no ramp or ramp cut. As a result, we expect measurable performance increases over asymmetric and/or fractionally supported chamber designs, and an increase in safety related metrics. Likewise, any reliability issues that may occur in an action where cartridges are stripped from a magazine and fed into the chamber at an angle are also eliminated.

[0008] The orientation of the ammunition loaded in the end-block has a secondary effect of increasing the durability of the net assembly. This is due, at least in part, to the metal sides of the cartridges protruding several thousands of an inch outside the diameter of the end-block body. The bullpup (trigger forward of the chamber) configuration improves balance, providing easier handling (stable and “pointable”), and expands the lifetime ergonomic potential of the design. The design is engineered for “blast forward” safety in the event of a catastrophic failure.

[0009] Other aspects, features, benefits, and advantages of the present invention will become apparent to a person of skill in the art from the detailed description of various embodiments with reference to the accompanying drawing figures, all of which comprise part of the disclosure.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Like reference numerals are used to indicate like parts throughout the various figures of the drawings, wherein:

[0011] FIG. 1 is a first rear isometric view showing the left side of a carbine rifle according to one embodiment of the present invention;

[0012] FIG. 2 is a second isometric view showing the right side thereof;

[0013] FIG. 3 is a right side elevational view thereof;

[0014] FIG. 4 is a left side elevational view thereof;

[0015] FIG. 5A is an exploded isometric view of certain supporting structures in one embodiment of the rifle, with the barrel;

[0016] FIG. 5B is an isometric view of a frame or receiver of the rifle;

[0017] FIG. 5C is a side sectional view taken substantially along line **5**-**5** of FIG. 2;

[0018] FIG. 6 is a side elevation view showing the ammunition clip detached and the pump grip and action in a fully retracted or open position;

[0019] FIG. 7 is a rear isometric view of a loaded rotary ammunition clip according to one embodiment of the present invention;

[0020] FIG. 8 is a forward isometric view thereof;

[0021] FIG. 9 is an isometric partial view of the action mechanism in a fully opened position of a carbine rifle according to one embodiment of the present invention in which, for clarity, the frame and outer housing parts have been removed and the rotary ammunition clip is detached;

[0022] FIG. 10 is an isometric partial view similar to FIG. 9 with the ammunition clip inserted;

[0023] FIG. 11 is a similar view showing the rotary ammunition clip inserted and with the action mechanism components moved slightly forward so that the clip rotation lever has engaged the radial ratchet teeth on the rear face and advanced the ammunition clip body;

[0024] FIG. 12 is a similar view showing the action with the bolt partially advanced forward to push an ammunition cartridge out of its socket in the rotary clip and toward the chamber;

[0025] FIG. 13 is a similar view showing the action fully advanced forward to an in-battery position in which the ammunition cartridge is chambered and lock members are lowered into engagement with the bolt

[0026] FIG. 14 is a side elevation view similar to what is shown in FIG. 13 with the action fully in-battery and locked;

[0027] FIG. 14A is an isometric partial view similar to that shown in FIGS. 9-13, in which the trigger has been pulled, to disengage the sear from the hammer and allow the hammer to drop, striking the firing pin, which fires the cartridge, propelling the now displaced projectile through the barrel;

[0028] FIG. 15 is a similar view showing the action partially retracted, which lifts the locking block members and begins reset of the hammer;

[0029] FIG. 16 is a reverse (left) side isometric view showing the anti-rotation lever which has sensed

the absence of a projectile in the next ammunition socket and has blocked further rotation of the clip body;

[0030] FIG. 17 is a partially exploded isometric view of the carbine rifle;

[0031] FIG. 18 is a partial isometric view showing a chamber indicator in an UNLOADED position;

[0032] FIG. 19 is a similar view showing the chamber indicator in an LOADED position;

[0033] FIG. 20 is a left side partial isometric view with cover plate removed showing a trigger safety member in the FIRE position; and

[0034] FIG. 21 is a similar view showing the trigger safety member in the SAFE position.

DETAILED DESCRIPTION

[0035] With reference to the drawing figures, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to “one embodiment,” “an embodiment,” or “some embodiments” means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus appearances of the phrases “in one embodiment,” “in an embodiment,” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments.

[0036] “Forward” will indicate the direction of the muzzle and the direction in which projectiles are fired, while “rearward” will indicate the opposite direction. “Lateral” or “transverse” indicates a side-to-side direction generally perpendicular to the axis of the barrel. Although firearms may be used in any orientation, “left” and “right” will generally indicate the sides according to the user's orientation, “top” or “up” will be the upward direction when the firearm is gripped in the ordinary manner.

[0037] Referring first to FIGS. 1-4, therein is shown at **10** a carbine rifle according to one embodiment of the present invention. In general, this embodiment provides a rifle in a “bullpup” configuration, in which the ammunition is fed into a firing chamber and has a fire control group all located rearward of the grip and trigger. This embodiment is cycled manually as a pump-action that loads ammunition cartridges from circumferentially situated sockets in a rotating clip and replaces spent cartridge casings into the same sockets.

[0038] Referring now to FIG. 5A, therein is shown an exploded isometric view of selected structural components of the carbine rifle. There is a frame or receiver **12** to which a barrel **14** may be attached, such as by insertion into a barrel socket **16**. Attachment may be by any of several known means, such as a threaded engagement or clamping. Another supporting structural member is a grip rail **18** that can be received into a lower channel **20** of the receiver **12**. The grip rail **18** supports a trigger guard **22**, other trigger components (not shown), and a forwardly extending pump grip guide **24**. A top rail **26**, which engages with an upper channel **28** in the receiver **12**, may include a Picatinny (1913 MIL-STD) accessory attachment rail **30** along at least a portion of its upper surface. Referring also to FIG. 5B, the receiver **12** includes a longitudinal bolt channel **32** and various other sockets and slots that will be identified and explained in more detail below with respect to other features of the invention.

[0039] As shown in the right side sectional view of FIG. 5C, the assembled combination of the receiver **12**, grip rail **18**, pump grip guide **24**, and top rail **26** support and guide all of the moving components of the fire control group of parts and cycling the action, each of which will be described in more detail below.

[0040] Referring now to FIGS. 6-8, therein is shown a rotary ammunition clip assembly **34** detached from the rifle **10**. The clip assembly **34** includes a main body **36** having a series of longitudinally oriented cartridge sockets **38** circumferentially positioned around the periphery of the main body **36** in a parallel axis orientation. Each socket **38** receives a separate ammunition cartridge **40**. The cartridge **40** illustrated includes a metallic casing **42** and projectile **44**, such as a 10 mm pistol round. Alternatively, the present invention may be adapted for other calibers, rimmed cartridges, or shotgun shells. The main body **36** has an axially centered opening **46** which is used to orient and hold the clip assembly **34** in place in the rifle **10**, and which provides a rotation axis. Each of the cartridge sockets **38** is less than a complete tube, having a peripheral slot positioned radially outward to allow a bolt assembly to pass through the sockets **38**, as will be described separately below. A rear face of the main body **36** also includes a series of radially oriented ratchet teeth **48**, which are used for indexing and rotationally advancing the clip assembly **34** when the action is cycled. An annular groove **50** is provided around the rear periphery of the main body **36** to allow passage of an extractor (not shown) from one cartridge **40** to another as the clip assembly **34** is rotated.

[0041] Referring now to FIG. 5C, a forward pump grip **52** is carried by upper and lower cross pins **54**, **56** that are guided by a first guide channel **58** in the top rail **26** and a second guide channel **60** in the pump grip guide **24**. The upper cross pin **54** secures the pump grip **52** to an operating rod **62**, which is guided by third and fourth cross pins **64**, **66** carried by the top rail **26**. Longitudinal movement of the pump grip **52** results in corresponding longitudinal movement of the operating rod **62**. The operating rod **62** engages a bolt **68**, which is carried in the bolt channel **32** of the receiver **12** in an aft portion of the rifle **10**. The pump grip **52**, operating rod **62**, and bolt **68** are shown in the forwardmost, in-battery position in FIG. 5C. Referring now also to FIG. 6, the pump grip **52**, operating rod **62**, and bolt **68** are shown cycled to the rear position, which allows insertion and removal of the clip ammunition clip assembly **34**. If desired, the pump grip **52** may be at least partially spring biased toward the forward, in-battery position by a compression spring (not shown) situated around the pump grip guide **24**, forward of the grip rail **18**.

[0042] Referring now also to FIG. 9, the action (operating rod **62** and bolt **68**) is shown in the fully retracted, open position. The ammunition clip assembly **34** may be inserted vertically into position and held in place by the axis rod **70**, which engages the center opening **46** of the main body **36**. The axis rod **70** may be spring biased toward a rear, engaged position and locked in a forward, open position by rotation of the thumb latch **72** in the thumb latch slot **74** of the grip rail **18**. As shown in FIG. 10, when the clip assembly **34** is inserted in place, a forward tooth **76** of the rotation index lever **78** will engage the ratchet teeth **48**.

[0043] Referring now to FIG. 11, as the operating rod **62** is partially moved forward by manual movement of the pump grip **52**, the rear end **80** of the operating rod **62** disengages from the upper arm of the rotation index lever **78**, which is spring biased (not shown) toward the forward position. This causes the lower arm of the rotation index lever **78** to swing downwardly, and the engagement between the forward tooth **76** and ratchet teeth **48** cause the clip assembly **34** to advance one position. In the illustrated example, the clip assembly **34** includes ten longitudinal cartridge sockets **38**, allowing it to hold ten ammunition cartridges **40**. Accordingly, the clip assembly **34** is moved one-tenth of a full rotation, or 36 degrees.

[0044] The operating rod **62** engages the bolt **68** with a lost motion connection. Specifically, the operating rod **62** includes an engagement tooth **82** that is received in a longitudinally oriented engagement slot **84** provided in the top surface of the bolt **68**. Accordingly, the operating rod **62** may be partially advanced forward, releasing the rotation index lever **78** so that it may advance the clip assembly **34** one position. Further forward movement of the operating rod **62** causes the engagement tooth **82** to meet the forward end of the engagement slot **84** and begin forward advancement of the bolt **68**.

[0045] Referring now to FIG. 12, further forward advancement of the operating rod **62** by manual movement of the pump grip **52** (not shown in FIG. 12) allows a lower portion of the bolt **68** to enter a

cartridge socket **38** of the clip assembly **34**, advancing a cartridge **40** forwardly out of the socket **38** and toward a chamber **86** at the rear end of the barrel **14**. Unlike in most firearm designs, the bolt **68** is substantially the same diameter as the cartridge **40**, which allows the bolt **68** to pass through the socket **38**. As the operating rod **62** is further advanced, the bolt **68** moves the cartridge **40** into the chamber **86**. Because the socket **38** from which the cartridge **40** is delivered is substantially axially aligned with the chamber **86**, there is no angular movement of the cartridge **40** and no need for a feed ramp, which can affect the chamber strength in other designs.

[0046] When fully in-battery (FIGS. 13 and 14), a rim portion **88** of the cartridge **40** does not have to be fully supported. The rim portion **88** remains engaged with the extractor **90**, which can be a non-moving portion of the bolt **68**. The face of the bolt **68** is substantially the same diameter as the base of the cartridge **40**. The extractor **90** does not need to deflect, as it does in most bolt designs, because it engages the rim portion **88** of a cartridge **40** as the clip assembly **34** is upwardly inserted into position. The rim **88** of each cartridge is engaged and disengaged from the extractor **90** as the clip assembly **34** rotates between indexed positions. The annular groove **50** allows the extractor **90** to disengage one cartridge **40** as the main body **36** is rotated to its next indexed position, there the extractor **90** slides into engagement with the rim **88** of another cartridge **40**.

[0047] When the bolt **68** has reached its forward end of travel, locking blocks **92** are spring biased downwardly to engage locking grooves **94** on opposite sides of the bolt **68**. This engagement between the locking blocks **92** and locking grooves **94** hold the bolt **68** in-battery for firing.

[0048] Referring now to FIG. 14A, a trigger **96** is pivotally carried by the grip rail **18** (not shown in FIG. 14A). The upper end of the trigger **96** is pivotally connected to an elongated sear **98**. A rearward pull on the lower end of the trigger **96** causes corresponding forward movement of the upper end and of the sear **98**. This forward movement causes the sear **98** to disengage the spring biased hammer **100**, allowing the hammer **100** to pivotally drop against the firing pin **102** carried by the bolt **68**. In the well-known manner, the hammer **100** striking the firing pin **102** causes the cartridge **40** to discharge, propelling a projectile through the bore of the barrel **14**.

[0049] After firing, the rifle **10** may be manually re-cocked by cycling the action with the pump grip **52**. Referring now to FIG. 15, as the pump grip **52** is pulled rearwardly to manually cycle the action, the operating rod **62** is moved to the rear, as well. This rearward movement begins to lift the hammer **100** back toward its set position. At the same time, a lift ramp **104** on the upper surface near the rear end **80** of the operating rod **62** engages a cross pin **106** engaged with the locking blocks **92**, lifting the locking blocks **92** out of engagement with the locking grooves **94** of the bolt **68**. The cross pin **106** may be guided by vertical slots **108** in the receiver **12**. The previously described lost motion connection between the operating rod **62** and the bolt **68** allows this initial rearward movement of the operating rod to lift the locking blocks **92** prior to causing any rearward movement of the bolt **68**.

[0050] Continued rearward movement of the pump grip **52** causes the operating rod **63** and bolt **68** to retract toward the rear. The bolt **68** passes through the cartridge slot **38** of the clip assembly **34** (as previously described with respect to FIG. 11), pulling the spent casing **42** with it. Continued retraction of the pump grip **52**, operating rod **62**, and bolt **68** will fully reset the hammer **100** into engagement with the sear **98** (as generally shown in FIG. 9A) and return the spent casing **42** to its socket **38** in the clip assembly. The final rearward travel of the operating rod **62** engages and displaces the rotation index lever **78** (as shown in FIG. 9A). This rearward rotation of the upper arm of the index lever **78** causes the forward tooth **76** to slide over the ratchet tooth to reset. In this position, the ammunition clip assembly **34** could be removed (by releasing the axis rod **70**), or the action may be cycled forwardly, causing the main body **36** of the ammunition clip assembly **34** to rotate one position and move a fresh cartridge **40** into the chamber **86**, as previously described.

[0051] Referring now to FIG. 16, once the final cartridge **40** has been chambered and fired, an anti-rotation lever **110** may be used to prevent further rotation of the clip assembly **34**. The spring biased anti-rotation lever **110** may be pivotally mounted to the frame **12** (not shown in FIG. 16) and include a

sensing finger **112** at its forward end. The sensing finger **112** is positioned to contact a projectile **44** when a loaded cartridge **40** is in the cartridge socket **38** next in line for advancement to a position in line with the bolt **68**. When the next in line cartridge **40** has already been fired, the absence of a projectile **44** allows the sensing finger **112** to partially drop into the cartridge slot **38**, blocking further rotation of the clip assembly **34**. This signals to the user that the ammunition clip **34** is empty and needs to be replaced.

[0052] As previously described, the “empty” clip assembly **34** retains the spent casings **42** and are removed by the user together (i.e., en bloc). This may then be replaced with another clip assembly **34** carrying loaded ammunition cartridges **40**. The spent casings **42** may be manually removed from the clip assembly **34** and replaced with fresh ammunition after the clip assembly **34** has been detached from the rifle **10**. Unlike the cylinder of a revolver, where the ammunition is fired while in each of the chambers, the ammunition cartridges **40** in this embodiment are individually moved from the socket **38** to the barrel chamber **86** for firing. Thus, the clip assembly **34** can be made from lightweight, low cost material, such as aluminum, die cast metals, injection molded plastic, etc. The clip assembly **34** may even be considered disposable and not reloaded after the cartridges **40** have been fired.

[0053] Referring now to FIG. 17, the rifle **10** is shown partially exploded to illustrate the removeable left and right side panels **114**, **116**, stock housing **118**, and butt plate **120**. The side panels **114**, **116** may not be essential to operation of the rifle **10**, but provide some protective function in addition to providing a smooth exterior appearance. The stock housing **118** receives and helps to support the ammunition clip assembly **34**. It also supports the rotation index lever **78**. A butt plate **120** may be attached to the stock housing **118** and may be made of a cushioning material and/or spring mounted to absorb recoil.

[0054] Safety features of the invention can include a loaded chamber indicator. This indication is provided by locking blocks extensions **122** that are exposed to the exterior of the rifle **10**. When the locking blocks **92** are lifted, the extensions are exposed (as shown in FIG. 18) to provide a visual and tactile indication that the bolt **68** is retracted to an open position and there is no cartridge **40** in the chamber **86**. When the bolt **68** is closed, the locking blocks **92** fall to lock the bolt **68** in battery and the locking block extensions **122** also retract behind the side panels **114**, **116** (as shown in FIG. 19). Guides **124**, **126** in the receiver **12** and/or the side panels **114**, **116** can be provided to align the extensions **122** as they extend and retract.

[0055] Another safety feature can include a retractable trigger cover **128** that is vertically movable between raised (FIG. 20) and lowered (FIG. 21) positions. The trigger cover **128** is carried on the grip rail **18** and may be guided in slots **130**, **132** in the grip rail **18** and/or side panels **114**, **116**. When lowered, as shown in FIG. 21, sides of the cover **128** provide a curtain that physically blocks access to the trigger **96**, filling the trigger guard **22**. The cover can also include a blocking finger **134** that is aligned to block forward pivotal movement of the upper portion of the trigger **96**. Conversely, the blocking finger **134** may include a notch **136** or other accommodation to allow pivotal movement of the trigger **96** when the cover **128** is raised.

[0056] The resulting firearm of this invention is one that is inherently fully ambidextrous, requiring no change-over from left- to right-handed shooting. The design can easily be adapted for use with a muzzle-attached noise suppressor or integral suppression. There are no concerns of reliability due to varied back pressure and no loss of energy due to auto-cycling the action or gaps in the system (as are found in a revolver having multiple chambers in a cylinder that must mate to a separate barrel. As with other pump-action systems, the action is completely mechanical and does not rely on gas flow/pressure or timing to unlock and cycle the system. All of the propellant energy of the cartridge **40** is used to propel the projectile, so velocity and internal ballistics are maximized.

[0057] While one embodiment of the present invention has been described in detail, it should be apparent that modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. Therefore, the foregoing is intended only to be illustrative of the principles

of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation shown and described. Accordingly, all suitable modifications and equivalents may be included and considered to fall within the scope of the invention, defined by the following claim or claims.

Claims

1. A pump-action firearm, comprising: a frame; a barrel having a chamber and supported on the frame; a rotating ammunition clip with a plurality of circumferentially spaced cartridge sockets, the clip removably supported by the frame; a bolt manually slidably cycled between in-battery and retracted positions, the bolt moveable into a socket to push a cartridge out of the socket and into the chamber to the in-battery position and retractable to extract the cartridge from the chamber and back into the socket.

2. The firearm of claim 1, further comprising a mechanism for rotatably advancing the clip to align an adjacent socket with the chamber each time the bolt is manually cycled.

3. The firearm of claim 2, wherein the clip includes a series of ratchet pawls and the mechanism includes a ratchet lever configured to interact with the pawls.

4. The firearms of claim 1, further comprising at least one block member vertically movable between a locked position in which the block member engages the bolt when in the in-battery position and an unlocked position in which the block member is disengaged from the bolt.

5. The firearm of claim 4, wherein a cam operably connected to the bolt moves the block member when the bolt is cycled.